FORMULARIO.

MOVIMIENTO MRUA

~~[illegible]~~

combinado.

2

Dificil

$$\Delta\vec{r} = \vec{r}_f - \vec{r}_i$$

$$\vec{V} = \frac{\vec{X}_f - \vec{X}_i}{\Delta t}$$

$$\vec{a} = \frac{\vec{V}_f - \vec{V}_i}{\Delta t}$$

$$X_f = X_0 + \frac{1}{2}(V_0 + V_f)t$$

$$V_f = V_0 + at$$

$$X_f = X_0 + V_0 t + \frac{1}{2}at^2$$

$$V_f^2 = V_0^2 + 2a(X_f - X_0)$$

Movimiento Relativo

$X_{B/A} = X_B - X_A$ ó $X_B = X_A + X_{B/A}$

posición relativa de B respecto de A

$V_{B/A} = V_B - V_A$ ó $V_B = V_A + V_{B/A}$.

Si $V_{B/A} > 0$ desde A se ve que B se mueve en dirección positiva.

$a_{B/A} = a_B - a_A$ ó $a_B = a_A + a_{B/A}$

11.33 $V_0 = 36\,\frac{Km}{h}$ $V_f = 90\,\frac{Km}{h}$

$(X_f - X_0) = 0.2\,Km$

a) Determinar la aceleración del auto.

$V_f^2 = V_0^2 + 2a(X_f - X_0)$.

$\Rightarrow \frac{V_f^2 - V_0^2}{2(X_f - X_0)} = a$

$a = \frac{(90)^2 - (36)^2\,[Km/h]}{2\,(0.2\,Km)} = \frac{6804\,Km^2/h^2}{0.4\,\cancel{Km}}$

$a = 17{,}010.\ Km/h^2 = \left(\frac{1000\,m}{1\,Km}\right)\left(\frac{1\,h}{3600\,s}\right)^2$

$\boxed{a = 1.3125\,m/s^2}$

b) El tiempo requerido para alcanzar 90 Km/h.

$V_f = V_0 + at \Rightarrow t = \frac{V_f - V_0}{a}$

$t = \frac{(90 - 36)\,Km/h}{17{,}010\,Km/h^2} = 3.174\times10^{-3}\,h$

$\boxed{t = 11.43\,s}$

11.34 $X_f = 164\,m$, $t = 8\,s$, $a = -0.5\,m/s^2$

a) Determinar su velocidad inicial.

$X_f = X_0 + V_0 t + \frac{1}{2}at^2$ si $X_0 = 0$.

$\Rightarrow X_f = V_0 t + \frac{1}{2}at^2$

$\Rightarrow \frac{X_f - \frac{1}{2}at^2}{t} = V_0$

$\Rightarrow \frac{X_f}{t} - \frac{1}{2}at = V_0$

$\frac{164\,m}{8\,s} - \frac{(-0.5\,m\,s^{-2})(8\,s)}{2} = V_0$

$\Rightarrow 20.5\,m\,s^{-1} + 2\,m\,s^{-1} = V_0$

$\boxed{22.5\,m\,s^{-1} = V_0}$

b) Su velocidad final.

$V_f = V_0 + at = 22.5\left[\frac{m}{s}\right] + (-0.5)\left[\frac{m}{s^2}\right]8\,s$

$V_f = 22.5\,m\,s^{-1} - 4\,m\,s^{-1} = \boxed{18.5\,m\,s^{-1}}$

c) Distancia recorrida durante los primeros 0.6 s.

$X_f = X_0 + V_0 t + \frac{1}{2}at^2$

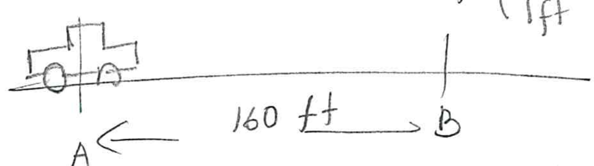
$(X_f - X_0) = V_0 t + \frac{1}{2}at^2$

$\Rightarrow (X_f - X_0) = (22.5)(0.6) + \frac{1}{2}(-0.5)(0.6)^2$

$= 13.5\,m - 0.09\,m = \boxed{13.41\,m}$

11.36 $a = 11\,ft/s^2$

$\rightarrow V_A = 30\,mi/h$ $\quad 160\,ft\left(\frac{0.3048\,m}{1\,ft}\right) = 48.768\,m$



a) Determinar el t requerido para que el auto alcance el punto B.

Primero convirtamos:

$a = \frac{11\,ft}{s^2}\left(\frac{0.3048\,m}{1\,ft}\right) = 3.3528\,\frac{m}{s^2}$

$V_A = \frac{30\,mi}{h}\left(\frac{1609\,m}{1\,mi}\right)\left(\frac{1\,h}{3600\,s}\right) = 13.41\,\frac{m}{s}$

$\Rightarrow$ Usemos $V_f^2 = V_0^2 + 2a(X_f - X_0)$

$\Rightarrow V_f = \sqrt{(13.41)^2\left[\frac{m^2}{s^2}\right] + 2\left[3.3528\,\frac{m}{s^2}\right][48.768]}$

$V_f = \sqrt{179.8281 + 327.018\left[\frac{m^2}{s^2}\right]}$

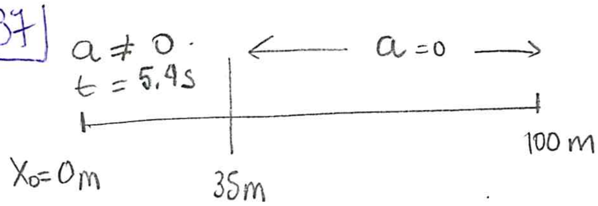
$V_f = \sqrt{506.8461} = \boxed{22.51\,m/s}$

$\Rightarrow V_f = V_0 + at \rightarrow \frac{V_f - V_0}{a} = t$

$t = \frac{(22.51 - 13.41)\, m/s}{3.3528\, m/s^2} = \boxed{2.71\, s}$

$V_f = 22.51 \frac{m}{s}\left(\frac{1\, mi}{1609\, m}\right)\left(\frac{3600\, s}{1\, h}\right) = \boxed{50.36 \frac{mi}{h}}$

11.37



a) Determinar su aceleración.

$x_f = x_0 + V_0 t + \frac{1}{2} a t^2$

con $x_0 = 0\, m$ y $V_0 = 0\, m/s$ y $x_f = 35\, m$

$\Rightarrow \frac{2x_f}{t^2} = a = \frac{2(35\, m)}{(5.4\, s)^2} \Rightarrow$

$\boxed{a = 2.4\, m/s^2}$

b) Su velocidad final.

$V_f = V_0 + at$

$V_f = 0 + 2.4 \frac{m}{s^2}(5.4\, s)$

$\boxed{V_f = 12.96\, m/s}$

c) Su tiempo en la carrera.

1º etapa 0-35m.

$\frac{V_f - V_0}{a} = t_1$

$\frac{12.96\, m s^{-1}}{2.4\, m s^{-2}} = t_1 = \boxed{5.4 s}$

2º etapa 35-100m

$x_f = x_0 + V_0 t + \frac{1}{2} \cancel{a} t^2 \quad a = 0$

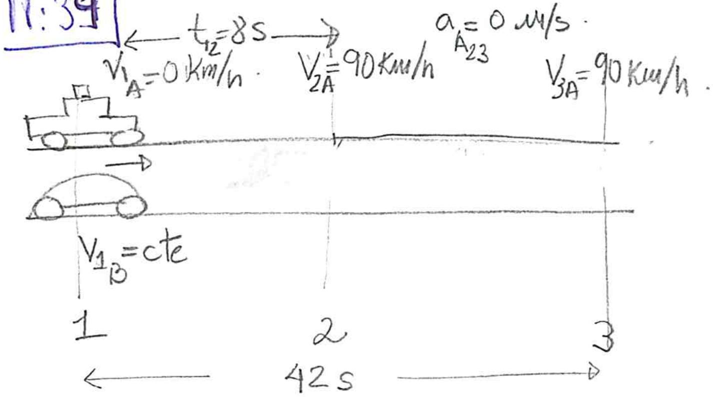
$\Rightarrow \frac{x_f - x_0}{V_0} = t_2 = \frac{100 - 35\ [m]}{12.96\, [m s^{-1}]}$

$t_2 = 5.015 s$

$\therefore t_{carrera} = t_1 + t_2 = (5.4 + 5.015)\, [s]$

$t_{carrera} = \boxed{10.415\, s}$

11:39



a) Determinar la distancia que recorrió el oficial hasta alcanzar al automovilista.

Primero podría calcular $a_{A_{12}}$ es decir

$a_{A_{12}} = \frac{V_{2A} - V_{1A}}{t_{12}}$

con $V_{2A} = 90 \frac{Km}{h}\left(\frac{1000\, m}{1\, Km}\right)\left(\frac{1\, h}{3600\, s}\right) = 25\, m/s.$

$\Rightarrow a_{A12} = \frac{25\, m s^{-1}}{8\, s} = 3.125\, m s^{-2}$

$\therefore V_{2A}^2 = V_{1A}^2 + 2a_{12}(X_{2A} - X_{1A})$

si $X_{1A} = 0$ y $V_{1A} = 0$

$\Rightarrow X_{2A} = \frac{V_{2A}^2}{2a_{12}} = \frac{(25\, m s^{-1})^2}{2(3.125\, m s^{-2})}$

$\boxed{X_{2A} = 100\, m}$

luego $t_{A13} = 42 s$ pero

$t_{A13} = t_{A12} + t_{A23}$

$t_{A13} = (18 s + 8) + t_{A23}$

$42 s - 26 s = t_{A23}$

$X_{A13} = X_{A12} + X_{A23} = 100 + X_{A23}$.

$X_{A23} = \cancel{X_{A2}}^{\,0} + V_{A2} t_{23}$ cuerpo A

$= 100 + (25\, m \cdot s^{-1})(16\, s)$

$X_{A23} = 400\, m$.

$\Rightarrow \boxed{X_{A13} = 500m = 0,5 Km}$

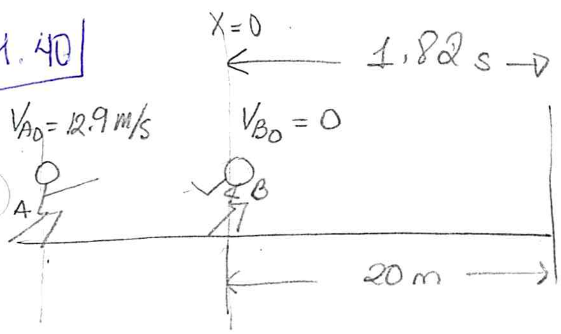
Para el cuerpo B.

$X_{B13} = X_{B1} + V_{B1} t_{13}$ como $X_{B1} = 0$.

$\Rightarrow \frac{X_{B13}}{t_{13}} = V_{B1} = \frac{500m}{42s} = 11,91\, m/s$

$\boxed{V_{B1} \approx 42.9\, Km/h.}$

11.40



$V_{fA} = V_{fB}$

$X_{fA} = X_{0A} + V_{0A} t + \frac{1}{2} a_A t^2$

$X_{fB} = X_{0B} + V_{0B} t + \frac{1}{2} a_B t^2$

pero $X_{fA} = X_{fB} = 20m$

$X_{0A} = X_{0B} = 0$

luego $20m = 12.9\, m s^{-1}\, t + \frac{1}{2} a_A t^2$

$$\frac{2\,(20m - 12.9\, m s^{-1}(1.82s))}{(1.82s)^2} = a_A$$

$$\frac{2\,(20 - 23.478)}{(1.82s)^2} = -2,099\, m/s^2$$

$\Rightarrow \boxed{a_A = -2,10\, m/s^2}$

$V_{Af}^2 = V_{A0}^2 + 2a_A\,(X_{fA} - X_{0A})$

$V_{Af}^2 = \left(12.9\, \frac{m}{s}\right)^2 + 2\left(-2,10\, \frac{m}{s^2}\right)(20\, m)$

$V_{Af}^2 = 166.41\, \frac{m^2}{s^2} - 84\, \frac{m^2}{s^2}$

$V_{Af}^2 = 82.41\, m^2/s^2 \Rightarrow \boxed{V_{Af} = 9.0779\, m/s}$

Como $V_{Af} = V_{Bf}$.

$\Rightarrow \frac{V_{fB} - V_{0B}}{2\,(20m)} = \boxed{a_B = 2,06\, m/s}$

b) ¿Cuándo tiene que empezar su carrera el corredor B?

$\Rightarrow x_{fB} = x_{0B} + V_{0B} t + \frac{1}{2} a_B t^2$

con $x_{0B} = 0$, $V_{0B} = 0$.

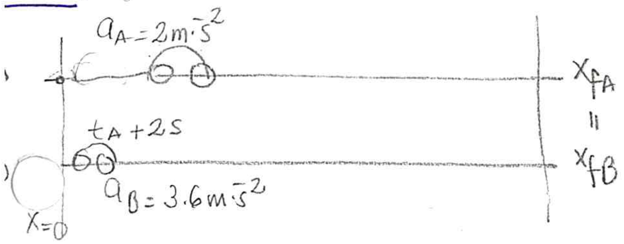
$\Rightarrow x_{fB} = \frac{1}{2} a_B t^2$

$\frac{2\, x_{fB}}{a_B} = t_B^2 = \frac{2\,(20m)}{2,06\, m \cdot s^{-2}} = t_B^2$

$t_B = 4.40\, s$.

$\therefore\ t_B - t_A = 4.40s - 1.82 = \boxed{2.59 s}$

1.43



a) Determine cuando y dónde B alcanzará a A

$$x_{fA} = x_{0A} + V_{0A} t_A + \frac{1}{2} a_A t_A^2$$

$$x_{fB} = x_{0B} + V_{0B} t_B + \frac{1}{2} a_B t_B^2$$

$$x_{0A} = x_{0B} = 0\ m$$

$$V_{0A} = V_{0B} = 0\ m \cdot s^{-1}$$

$$\Rightarrow x_{fA} = \frac{1}{2} a_A t_A^2$$

$$x_{fB} = \frac{1}{2} a_B t_B^2 \quad \text{pero} \quad t_B = t_A + 2s$$

$\Rightarrow$ y $x_{fA} = x_{fB}$ ∴

$$a_B t_B^2 = a_A t_A^2$$

$$\Rightarrow 3.6 \frac{m}{s^2} t_B^2 = 2 \frac{m}{s^2} t_A^2$$

$$\frac{3.6\ m/s^2}{2\ m/s^2} t_B^2 = t_A^2$$

$$1.8\, t_B^2 = t_A^2$$

$$\sqrt{1.8}\, t_B = t_A \Rightarrow \sqrt{1.8}\,(T_A + 2s) = t_A$$

$$\sqrt{1.8}\, t_A + 2\sqrt{1.8}\, s - t_A = 0$$

$$t_A(\sqrt{1.8} - 1) = -2\sqrt{1.8}$$

$$t_A = \frac{-2\sqrt{1.8}}{\sqrt{1.8} - 1} = \frac{2.68}{0.34}$$

$$\boxed{t_A = -7.89 s}$$

luego donde $\Rightarrow$ regresamos a:

b) $x_{fB} = \frac{1}{2}(3.6\ m/s^2)(7.89 - 2)^2 = \boxed{61.60\ m}$

ojo explicar porque se restan los 2s.

c) la velocidad de cada automóvil cuando se encuentran.

$$V_{fB}^2 = \cancel{V_{0B}^2}^{\,0} + 2a_B(x_{fB} - x_{0B})$$

$$V_{fB}^2 = 2(3.6 \frac{m}{s^2})(61.60 m)$$

$$V_{fB}^2 = 443.52\ m^2/s^2$$

$$\boxed{V_{fB} = 21.06\ m/s}$$

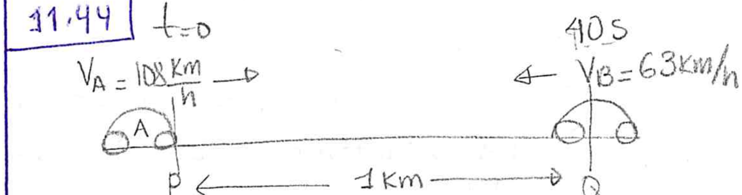
y para el vehículo A.

$$V_{fA} = V_{0A} + a_A t_A$$

$$V_{fA} = a_A t_A = (2\ m/s^2)(7.89 s)$$

$$\boxed{V_{fA} = 15.78\ m \cdot s^{-1}}$$

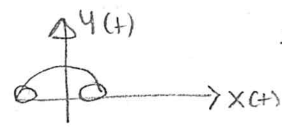
11.44



$$V_A = 108 \frac{Km}{h}\left(\frac{1000 m}{1 Km}\right)\left(\frac{1 h}{3600 s}\right) = 30\ m/s$$

$$V_B = 63 \frac{Km}{h} = 17.5\ m/s.$$

tomamos como referencia el carro A



$$\Rightarrow V_A = 30 m/s$$

$$V_B = -17.5 m/s.$$

$$\Rightarrow x_{fA} = x_{0A} + V_{0A} t_A + \frac{1}{2} a_A t_A^2$$

$$x_{fB} = x_{0B} + V_{0B} t_B + \frac{1}{2} a_B t_B^2$$

luego $x_{0A} = 0$, $x_{0B} = 1000 m$

cuando se encuentran $x_{fA} = x_{fB}$.

$$\Rightarrow V_{0A} t_A + \frac{1}{2} a_A t_A^2 = 1000 m + V_{0B} t_B + \frac{1}{2} a_B t_B^2$$

pero $t_B = t_A + 2s$

carro azul

$V_A = 108\ km/hr$

carro rojo

V_{R1}

$V_R = 63\ km/hr$

1 Km

p — q

42 s.   40 s

$X_{oA} = 0$ $X_{oR} = 1\ km$

$V_{oA} = 108\ km/hr$

$V_{oA} = 30\ m/s$ $V_{oR} = -17.5\ m/s$

$X_A = X_0 + V_0 t + \frac{1}{2} a_A t^2$

$X_B = X_0 - V_0 t - \frac{1}{2} a_R t^2$

$X_B = 1\ km - V_0 t - \frac{1}{2} a_R t^2$

$X_B = 0$ $\frac{1}{2} a_R t^2 = (1000m - \cancel{00}17.5\ m/s$

$a_R = \frac{2(1\times10^3 - 735)m}{(42)^2} = 0.3\ m/s^2$

a_A ?

a_R ?

$X_A = V_0 t + \frac{1}{2} a_A t^2$

$t = 40s \Rightarrow X_A = 1\ km = 1\times10^3 m$

$\frac{a_A t^2}{2} = X_A - V_0 t$ $a_A = \frac{2(X_A - V_0 t)}{t^2}$

$a_A = \frac{2(1\times10^3 - 1.2\times10^3)m}{(40)^2} = \cancel{\frac{2(2.2\times10^3)m}{1.6\times10^3 s^2} = \frac{4.4\times10^3}{1.6\times10^3} m/s^2 = \frac{2.2}{0.8} m/s^2 = \frac{1.1}{0.4} m/s^2}\ 2.75\ m/s^2$

$\frac{2(1000 - 1200)}{40\cdot 40} m/s^2 = \frac{2(-200)}{40\cdot 40} = \frac{-400}{40\cdot 40} = -\frac{1}{4} = -0.25\ m/s^2$

a) $a_A = \cancel{2.75\ m/s^2}$ | $0.25\ m/s^2$

$a_R = 0.3\ m/s^2$

$$\cancel{X_A} = \cancel{X_0}^{0} + V_{0R}t + \frac{1}{2}a_A t^2$$

$$X_R = X_{0R} + V_{0R}t - \frac{1}{2}a_R t^2$$

$\therefore X_A = X_R$

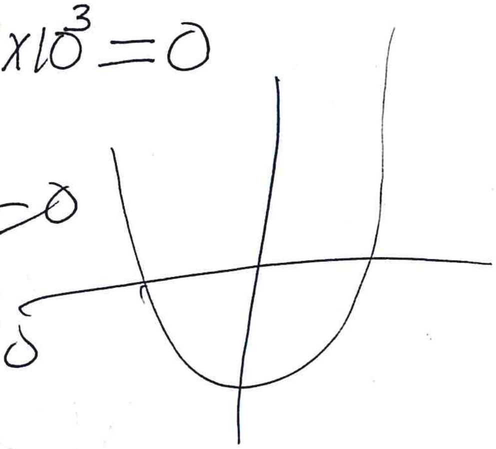
$$V_{0R}t + \frac{1}{2}a_A t^2 = X_{0R} - V_{0R}t - \frac{1}{2}a_R t^2$$

$$30\,m/s\,t - \frac{1}{8}t^2 = 1\times10^3 - 17.5\,m/s\,t - \frac{1}{6}t^2$$

$$\left(\frac{-1}{8} + \frac{1}{6}\right)t^2 + (30 + 17.5)t - 1\times10^3 = 0$$

$$\left(\frac{-3}{24} + \frac{4}{24}\right)t^2 + (47.5) - 1\times10^3 = 0$$

$$\underbrace{\left(\frac{1}{24}\right)}_{a}t^2 + \underbrace{(47.5)}_{b}t - \underbrace{1\times10^3}_{c} = 0$$



$(x-$

$(a+b)^2 = a^2 + 2ab + b^2$

$$t = \frac{-b \pm \sqrt{4ac - b^2}}{2a}$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$at^2 + bt + c = 0$

$at^2 + \frac{1}{2}a +$

$t^2 + \frac{b}{a}t + \frac{c}{a} = 0$

$t^2 + \frac{1}{2}t + 0$

$$t = \frac{-47.5 \pm \sqrt{(47.5)^2 + \frac{4}{24}\cdot 1000}}{\frac{2}{24}}$$

$$t = \frac{-47.5 \pm 49.2}{1/12}$$

$t = 12\,(\,\text{—}\,) = 20.68s$